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The Package Size Effect: How Package Size Affects Young Children's Consumption of Snacks Differing in Sweetness

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1. Introduction

The liking of sweets is highest during childhood and decreases into adulthood (Liem & De Graaf, 2004). Strong preferences for sugared foods during childhood have been suggested to function as cues to direct humans to sources of calories, particularly during times of growth (Coldwell, Oswald, & Reed, 2009; Drewnowski, 2000). Food advertising directed to children mainly includes snacks and fast food that are preferred because of their sweetness and next to containing sugar the consumption of these products also regularly exceeds the daily recommended amounts of fat and salt (Botha, Fentonmiller, Jennings, Johnson, Young, Hippsley et al., 2008; Lodolce, Harris, & Schwartz, 2013). The marketing of these unhealthy foods to children presents significant public health risk and is known to be an important factor that could cause childhood obesity (EU Pledge, 2015; Neyens & Smits, 2016; Persson, Soroko, Musicus, & Lobstein, 2012; WHO, 2012). In recent years, marketers have increased their use of nontraditional media and marketing opportunities to reach young consumers. One such marketing communication medium is the product packaging itself and it can include a lot of different persuasive consumption cues. The biggest asset of packaging as a marketing communication tool is that, unlike traditional advertising, it reaches people at the time of purchase and of consumption, the two critical "moments of truth" (Chandon, 2013).

The majority of research about children's food consumption as affected by packaging has centered on the inclusion of persuasive techniques such as endorsement that has an impact on children's preferences (Smits, Vandebosch, Neyens, & Boyland, 2015). These packages very often feature endorsers, such as Elmo and Dora the Explorer (Harris, Schwartz, & Brownell, 2010; Hebden, King, & Kelly, 2011). Children's perceptions and expectations about food products are influenced by packaging. It has been demonstrated that children are very suggestible for external cues when presented with food packages (Kunkel,

Wilcox, Cantor, Palmer, Linn, & Dowrick, 2004; Mau, Klein, & Reisch, 2014). At the age of four to five, children learn social and cultural conventions regarding food and begin to make the transition to an adult diet (Birch & Fisher, 1995; Johnson & Birch, 1994). They will be socialized by environmental cues, such as package and portion sizes, to adopt adult-like attitudes about food and food consumption (Van Kleef, Kavvouris, & Van Trijp, 2014; Young & Nestlé, 2002).

2. Theoretical Framework

With regard to food consumption, we have come to expect large portion sizes, which is evident from the amount of super-sized food items available in the supermarket (Young & Nestlé, 2002). A large package size provides manufacturers discretion in setting the serving size and encourages increased consumption. The doubling of a size of a package has generally translated into a 18% to 25% increase in consumption for many meal related foods, such as spaghetti and a 30% to 45% increase for many snack-related foods (Wansink, 1996). Earlier research also showed that adults eat less of smaller snack portions, although they eat feel equally satisfied as the ones who were given a substantially larger portion (Van Kleef, Shimizu, & Wansink, 2013). So, evidence was found that actual serving primes affect adults. People eat more from packages larger in size and content than from smaller ones, which is known as the *package size effect* (Chandon, 2013; Wansink & Kim, 2005). Large portions may increase consumption partly because they suggest larger consumption norms: they implicitly suggest what might be construed as a "normal" or "regular" amount to consume (Harris, Brownell, & Bargh, 2009; Van Kleef et al., 2013; Wansink & Kim, 2005; Wansink & Chandon, 2014). Regular refers to how much is suggested on the nutrition label as one individual portion. People often misinterpret such portion suggestions (Brand, Wansink, & Cohen, 2016). Marchiori, Papies, and Klein (2014) suggested that portion and package sizes

are used as anchor quantities, such that consumers take the size of the portion or pack as a reference amount. Another recent study found that even serving suggestions depicted on-pack influence consumers expectations (Rebollar, Lidón, Gil, Martín, Fernández, & Rivere, 2016).

Interestingly, most studies investigating the effect of package sizes or on-pack serving size suggestions concerned adult consumers. For instance, in a 2×2 between-subjects design (Wansink & Kim, 2005), adult moviegoers were randomly given a medium (120 g) or a large (240 g) pack of popcorn that was either fresh or stale (14 days old). Findings of this study indicated that perceived taste and quality had little impact on how much popcorn was eaten. The package size was the most important predictor for intake. A similar study with younger participants has not been conducted yet. This marketing cue could impact children as well. Young children lack the capacity to easily recognize marketing cues. It has been found that children's awareness of such cues develops by the age of eight, however it does not yet reach the adult level (Rozendaal, Buijzen, & Valkenburg, 2010). As children grow older, they are socialized to adopt an adult diet as well and will learn social conventions regarding food and food intake. During the early years of live, however, intake occurs especially in response to hunger and satiety cues (Weingarten, 1985). The latter defined hunger as: "a behavioral state activated when the energy levels of the organism are depleted, the net results of this is eating and the ingestion of nutrients". Depletion (i.e., a low blood glucose) results in the activation of eating behavior. Even children's ability to regulate is impressive, they can select a balanced diet (Davis, 1939). Children' development of self-regulation of energy intake is at its best when they maintain control on how much to eat (Johnson & Birch, 1994).

Chandon (2013) further summarized and suggested that people and especially children do not tend to focus on nutrition labels, but rather rely on visual size estimations, such as weight or volume to infer the amount of product in a package. Quantity information on labels is more difficult to process (Viswanathan, Rosa, & Harris, 2005) and therefore children tend

to base their consumption decisions on instant visual impressions of package and portion size. This suggests that they might be influenced by biased size perceptions, again suggesting that larger servings lead to overeating (Livingstone & Pourshahidi, 2014). Several studies already demonstrated that larger actual serving sizes and food energy density (kilocalories/gram) increase food consumption during meals in children (e.g. Small, Heather, Vaughan, Melnyk, & Mcburnett, 2013; Livingstone & Pourshahidi, 2014; Zlatevska, Dubelaar, & Holden, 2014). With the exception of children under three (Rolls, Engell, & Birch 2000), larger serving sizes significantly increased intake. Also for breakfast meals children demonstrate biased serving estimations. Wansink, Payne, and Werle (2008) measured children's requests for presweetened cereals but presented these children with different bowls. Children requested more than twice the amount of cereal in the larger bowl than in the smaller one. In one of the few studies on actual packaging cues affecting children's food consumption, Neyens, Aerts, and Smits (2015) even demonstrated that manipulated differences in depicted serving sizes on cereal boxes influenced children's (age 4 to 5) consumption.

Previous research about the effect of portion and package size on children's intake mainly demonstrated the impact of a meal's serving sizes. However, there is a lack of research regarding snacking behavior, which is very common among children. The frequency of snacking among preschool-aged children has increased such that over 25% of their energy intake today comes from snacks (Piernas & Popkin, 2010). Given these latest trends, the promotion of healthy snack eating is essential to better children's diet to prevent or even treat childhood obesity. Recently, in the multi-disciplinary COOL SNACKS project researchers obtained further insight into young people's snacking behavior (Grunert et al., 2016). As a project result, healthy snacks living up to adolescents' demands were developed. The researchers found that mixing healthy with less healthy elements and including fresh fruit specifically for girls and savory products specifically for boys increased the attractiveness of

the snacking solutions. Next to the development of healthy snack solutions, interventions can be set up to increase children's intake of healthy foods (Williams et al., 2014). While interventions may direct attention toward the quality of snacks offered to children, much less emphasis is placed on snack portion size. Snacking typically occurs in situations with less parental control, meaning that their modeling influence has a less significant role in children's snacking behavior than is the case with children's meal sizes. One of the first studies on this topic was Norton, Poole, and Raynor's (2015). They found that providing preschool children with a larger size of beverage with a snack increased beverage and/or food intake. The question now is whether children's snacking volume is influenced by the package size and whether this depends on the snack's sweetness?

We hypothesized (Hypothesis 1) that young children will eat more when presented a large sized snack package than when presented a regular sized snack package. Package sizes act as consumption norms (Harris et al., 2009). We reasoned that if children rely on the visual consumption cue provided by the package or package size and the related volume of food, they will be influenced by the package size cue and adjust their eating behavior from that reference amount (Livingstone & Pourshahidi, 2014). Second, children prefer sugary snacks over less sugared snacks because children have an innate soft spot for sweets (Cowart, 1981; Lodolce, et al., 2013). We can assume that children eat more of the sweetened food apart from the size of the package. We thus predicted children to eat more from sugared snacks than less sugared snacks (Hypothesis 2). Third, it is predicted that the effect of the package size is stronger for sugared snacks than the less sugared ones (Hypothesis 3), for instance because for those less sugared ones the internal cues of consumption volume will be more prominent. This is also in line with earlier findings by Wansink and Kim (2005) among adults consuming fresh versus stale popcorn and by Fisher and colleagues (2007) among 5 to 6 years old children consuming entrée meals. The latter found that entrée energy intake was

increased by 75% when the entrée energy density and portion size were simultaneously increased. Other techniques, such as endorser advertising, also showed to be even more persuasive for unhealthy foods than for healthy foods (Smits & Vandebosch, 2012).

With the present research we wanted to investigate to what extent the package size effect, which has been demonstrated for adults, applies to young children. We conducted two experiments in a controlled environment. The design of the first Experiment is a conceptual replication of Wansink and Kim (2005) popcorn study, who did this with adult participants. In the second Experiment we wanted to replicate the findings of our first Experiment. We also wanted to expand the scope of the findings by including different food types. Finally, we controlled for children's age, gender, the effects of BMI, overall liking of food and feelings of hunger, which are all variables often used in serving size studies with children (Small et al., 2013).

3. Experiment 1

3.1 Material and methods

3.1.1 Design

The experiment had a 2 (package size: large vs. regular) × 2 (popcorn: sugared vs. salted) between-participants design, and participants were randomly assigned to conditions.

3.1.2 Participants

The sample consisted of Flemish children between 6 and 7 years old. We selected children with such ages since they just passed the adiposity rebound, which is the period when children's BMI is at its lowest level. However, it is the moment when children are exposed to lots of advertising and consume more unhealthy foods (Huang, Howarth, Lin, Roberts, & McCrory, 2004). We contacted different schools and asked them to participate.

We informed them about the purpose of the Experiment using a standard letter. After approval by the school, we distributed information letters asking parents for participation of their child. Children could only participate if parents returned the informed consent form. None of the parents indicated their child was allergic or did not like popcorn. The institutional review board of (anonymous for peer review) approved the protocol of this study.

Eventually, children of four different classes of four different schools participated. In class 1, 28 of the 30 children participated, in class 2 it was 26 out of 28. In class 3 only 16 of the 21 children participated and in the last class 26 of the 28 children took part. In total, 107 children's parents were contacted, with a non-response of only 11. This led to a final sample of 96 participants of which 50 were boys (52.1%) and 46 were girls (47.9%). The participants were 6 or 7 years old, with an average age of 6.43 years (*SD* = 0.68).

3.1.3 Procedure

At the start of the Experiment the children were told that they could leave anytime they wanted. Before the children were exposed to the manipulated stimuli, they were measured and weighed. BMI was calculated by dividing the children's body weight by the square of their height. BMI criteria differ between children and adults, with childhood criteria based on percentiles rather than absolute scores. From the 85th percentile children are considered overweight (Barlow, 2007). Subsequently they were asked about their hunger and liking of popcorn. The hunger of children was assessed before the popcorn was served with a tool developed by Birch (1979) and used in previous studies (Fisher, 2007; Fisher et al., 2007). A series of three cartoon face drawings was presented, similar to a 3-point Likert-type scale (1 = not hungry; 2 = neutral; 3 = very hungry). The first cartoon drawing had a stomach being fully shaded to represent "not hungry", the shading decreased to the last stomach with

no shading at all representing "very hungry." Higher values represented greater hunger. Liking of each food was also assessed before the popcorn ,was served, using a three-point Likert-type scale (1=dislike; 2=neutral; 3=like) anchored with faces showing an expression of dislike (frown face), neutrality and like (smile face) similar to those used previously (Birch, 1979; Fisher et al., 2007). Higher values represented greater liking.

The four sessions took place in the children's own classroom on different Wednesday forenoons. Each child received a sticker with a serial number corresponding to the serial number on his or her individual popcorn cup. This ensured anonymous data collection. All participating children took a seat while watching a movie that took about one hour. They were told we wanted to show a new Easter movie (i.e., an unknown movie released abroad). As "a favor in return for participating and evaluating the movie" a popcorn cup for every child was provided. The cup was already filled, the children could not refill. Amount of popcorn consumed was determined by subtracting the individual cup's post-snack weight from pre-snack weight. Spillage did not occur during consumption, as monitored by the researcher. However, this process was filmed to control for unexpected circumstances such as children eating from each other's cups (only the cups were visible). No such circumstances occurred. Finally, participants were debriefed by means of a short text, and had the opportunity to give any comments they might have.

3.1.4 Materials

Per class, all children received the same type of popcorn and the four types of popcorn were randomly assigned to the four classes. This was either a regular (30g) or a large (60g) plain packaging of popcorn that was either sugared or salted. We used plain packaging to control for other marketing cues which are often on-pack of child directed food. Moreover, a prior study found that plain packaging (i.e., a packaging devoid of brand slogan, logo or

color) has no restrictive effect on actual consumption (Werle, Balbo, Caldara, & Corneille, 2016). When Wansink and Kim (2005) assessed popcorn consumption of adults, they used much larger portion sizes (120g vs 240g). However, we opted for the 30g and 60g cups because the regular portion size of 30g corresponds with the suggested serving size of popcorn in local retail. For instance, for the popcorn used, the retailer suggests a 25g serving size (for adults).

To verify the appropriateness of this serving size, we asked a convenience sample of parents with children aged 6 to 7 years to fill out a questionnaire about popcorn portion sizes. They were randomly presented two pictures of different popcorn sizes: the regular pack with 30 grams of popcorn ("regular" corresponds to how much is suggested as one portion) and the larger one with 60 grams content ("large" corresponds to a double suggested portion size; see Figure 1). Preliminary questions were: "Do you have a child with an age of 6 or 7?", "What is the exact age of your child?", "Does that child like popcorn?". Questions regarding the two popcorn package sizes were: "Do you think this is a normal portion size for a child aging 6 to 7 to consume when watching a movie?" (binary yes/no response), "This is a … portion size (answer with a score on the slider ranging from 0 to 100, with 0 anchored as "too small" and 100 as "too much")", "I think this portion is about… grams.". 14 out of 18 parents who filled out the survey had a child with an age of 6 or 7 (M = 6.89, SD = .76). The other 4 parents had a child of 8 years old.

When presented with the picture of the regular package size with popcorn, 11 out of 18 respondents thought it was a normal portion size, compared to only 7 parents who found the larger pack appropriate. With a mean score of 50.06 (SD = 12.79) the parents indicated the regular portion size as just right for their children to consume while watching a movie. In contrast, they found the larger pack less appropriate (M = 63.94, SD = 12.14, $t(17)$ = -5,708, $p < .001$). Interestingly, parents did correctly estimate the regular pack to contain fewer

grams than the large pack ($t(17) = -3.480$, $p = .003$), but they clearly overestimated the contents as 79 grams and 119 grams, respectively. Based on this pretest, we can conclude we used the appropriate recommended serving size for the regular and the larger portion condition.

Also differing from Wansink and Kim's (2005) design, we did not opt for fresh versus stale popcorn**.** In the original study this was included to assess the effect of food palatability with stale popcorn being the least preferable. In this study on children's consumption we rather want to investigate the effect of more subtle differences of a snack's palatability. Children have an innate soft spot for sweets and palatable food, so they are less likely to overeat when served less preferred foods (Cowart, 1981; Lodolce, et al., 2013). We therefore chose to use sugared versus salted popcorn, where we expected the sugared one to be somewhat more preferable to children.

Two different popcorn cups were used differing only in size. The regular cup has a volume of ca. 1 liter and the large one a volume of ca. 2 liter, with the regular pack filled with 30 grams of popcorn and the larger one with 60 grams content. Both cups were ordered online from misterpop.nl. Furthermore, two types of popcorn were used, differing in sweetness and hardly differing in caloric value: Jimmy's Popcorn Sweet™ (412kcal/100g), and Jimmy's Popcorn Salted™ (392kcal/100g).

[INSERT FIGURE 1 ABOUT HERE.]

Fig. 1 Popcorn cups (regular versus large cups).

3.2 Results

As Table 1 indicates, the children in each between-subjects randomized subsample were similar in terms of their age (6.4, 6.7, 6.5, and 6.3 years of age) and in terms of their gender mix (61.5%, 43.8%, 42.3%, and 57.1% male). The children had a mean BMI of 16.00

(*SD* = 1.84). About 14.5% of the children were overweight (*N* = 14, BMI 85th percentile). Children indicated they liked popcorn (*M* = 2.71, *SD* = .65; significantly exceeding the neutral 2 score: $t(95) = 10.72$, $p < .01$). The average value of hunger across all sessions was 2.72 (*SD* = .58, $t(95) = 12.25$, $p < .01$), which implies the children were rather hungry. An independent two way ANOVA analysis with package size and popcorn type as between-subjects factors verified that hunger did not vary significantly between the conditions ($F(2,87) = 1.45$, $p = .241$.

Table 1

Age and gender descriptives and significance tests per cell (*SD*).

	Large popcorn cup		**Regular popcorn cup**		
	Sugared (n = 26)	**Salted (n = 15)**	**Sugared (n = 26)**	**Salted (n = 28)**	**Statistical Test**
Age	6.4 (.5)	6.7 (1.0)	6.5 (.7)	6.3 (.5)	$F(3,92) = .73$, $p = .534$.
Gender, % male	61.5	43.8	42.3	57.1	$\chi 2 = 2.66$, $p = .447$.

A 2 × 2 ANOVA with package size and popcorn type as factors revealed a main effect of package size, $F(1, 92) = 120.85$, $p < .01$, $\eta p2 = .57$. Children ate more from the large cup (*M* = 51.21, *SD* = 13.79) than from the regular cup (*M* = 26.45, *SD* = 9.01), thus confirming the predicted package size effect (H1). Also the type of popcorn produced significant consumption differences, $F(1, 92) = 15.35$, $p < .01$, $\eta p2 = .14$. Children ate less when given salted popcorn (*M* = 30.70, *SD* = 14.03) compared to sugared popcorn (*M* = 41.83, *SD* = 17.91). This confirms H2. Thirdly, the interaction between package size and popcorn type was significant, $F(1, 92) = 5.89$, $p = .02$, $\eta p2 = .06$. Package size did affect consumption when children were presented with sugared popcorn: those ate more from the large package (*M* = 56.50; *SD* =12.25) compared to the regular package (*M* = 27.15; *SD* = 7.51), $t(50) =$

10.41, $p < .01$, $d = 2.94$. When the children got salted popcorn, the children also ate more from the large cup ($M = 42.63$; $SD = 11.95$) compared to the regular one ($M = 23.89$; $SD = 10.08$), $t(42) = 5.54$, $p < .01$, $d = 1.71$. As evidenced by the effect sizes, the package size effect is large and substantial for both popcorn types, but it is most prominent for sugared popcorn. This confirms H3: a larger package size effect was found for sugared foods than for less sugared foods. Figure 2 illustrates the popcorn consumption across the different conditions.

[INSERT FIGURE 2 ABOUT HERE.]

Fig. 2 Amount of consumption (in grams) per package size and popcorn type condition.

We then explored the potential role of pre-existing preferences of the food by including the liking of popcorn as a covariate. The ANCOVA showed that this variable indeed had a strong effect on consumption, $F(1,87) = 47.76$, $p < .01$, $\eta p2 = .35$. When children liked the popcorn more, they consumed more of it. The variables age $F(1,87) = 0.48$, $p = .49$, $\eta p2 = .01$), gender $F(1,87) = 2.18$, $p = .14$, $\eta p2 = .02$), 85th percentile of BMI $F(1,87) = 2.58$, $p = .11$, $\eta p2 = .03$ and feeling of hunger $F(1,87) = 1.70$, $p = .20$, $\eta p2 = .02$) did not have significant effects on popcorn consumption. The main effects of package size ($F(1,87) = 141.09$, $p < .01$, $\eta p2 = .62$) and of popcorn type ($F(1,87) = 9.84$, $p < .01$, $\eta p2 = .10$) remained after the inclusion of these covariates. Again, the interaction between package size and popcorn type was significant, $F(1,87) = 21.89$, $p < .01$, $\eta p2 = .20$.

3.3 Discussion

This is the first study to show that the package size of a snack indeed affects children's consumption. Our findings showed that an environmental cue, i.e. package size can influence the consumption of sugared and even less sugared snacks among kids. The results

revealed a clear package size effect, with participants consuming about 25 grams more from the large popcorn cup than from the regular one. It should be noted that this *package size effect* pertains to a manipulation of both the package size and the package contents. The separate effects of these two cannot be disentangled but, jointly, they refer to the real-life situation of different package sizes that also differ with regard to their contents. The relative increase in consumption was greater for the sugared popcorn than for the salted popcorn. Although a food's sugar content is related with consumption in controlled laboratory conditions, environmental cues can influence consumption of even non-sweets, such as the salted popcorn, in day-to-day situations.

Of course, it could be argued that many children in Experiment 1 just "cleaned their plate". However, this could not be considered as a limitation of our design, because we somewhat triggered internal reasons for stopping consumption. Participating children were weighed before the Experiment, which is likely a prime for children to consider what they are eating and could hold them back from eating much. It has been demonstrated that weighing exerts an influence on weight loss or weight gain (Linde, Jeffery, French, Pronk, & Poyle, 2005), indicating that weighing induces self-control regarding food intake which is related to weight loss or weight gain. Body image concerns, but also weight concerns have been reported in children as young as 6 years old. Children have also been found to employ techniques such as food restrictions in order to evoke change in their body weight (O'Dea & Caputi, 2001), and food restrictions may even decrease the extent to which children use internal signals of hunger (Birch & Fisher, 1995). This indicates that the use of this prime might somewhat compensate for the deprived hunger state of young children and dampen their consumption tendencies. Moreover, it has been demonstrated that strengthening inhibitory control can help to regain control over consumption (Houben, 2011). In the larger cups condition, children ate a volume of popcorn that doubles the manufacturer's suggested

adult serving size. We thus demonstrated that a larger than regular cup size clearly elicits a higher consumption volume. Still, we tried to accommodate to this possible limitation in Experiment 2 where we made the difference between the package size conditions larger to have somewhat less plate cleaning. Moreover, the content of the packages in Experiment 2 is expressed in proportions as compared to in grams as in Experiment 1.

In Experiment 2, we attempted to replicate and extend our findings to different snack types. This should increase the external validity of our experiment and thus provide a stronger test of the effectiveness of the package size manipulation. Children prefer sugared, less nutritious food over the healthier options (Lodolce, et al., 2013). Many scholars have therefore investigated whether marketing cues can also be applied to bolster healthy food liking and consumption among children. For instance, the often used endorsers that typically market unhealthy snacks have also been demonstrated to increase children's liking for fruit and vegetables (Smits et al., 2015). We thus included a healthy food type in our second study.

Finally, we also changed the consumption setting between Experiment 1 and Experiment 2. In the first study we mimicked a typical snacking situation like it often occurs during leisure time. Social activities play a role in purchasing and consuming novel snacks (Nørgaard, Sørensen, & Grunert, 2014). Others before demonstrated a link between TV viewing and food consumption (e.g., Coon, Goldberg, Rogers, & Tucker, 2001; Robinson, 1999). Prior research demonstrated that participants who watched a movie while snacking were less accurate in recalling the amount of snack food they had consumed (Mittal, Stevenson, Oaten, & Miller, 2010). Our study contributes to this literature in demonstrating that during TV viewing, children are susceptible to a pack size effect. In Experiment 2 we shifted to another common snack setting: breaks during school hours. This conceptual replication to a different consumption situation also pertains to differences in multitasking. Indeed, one can expect children to be more "transported" while watching TV than during

school breaks such that Experiment 2 also tries to shed light on the question whether package size effects occur in such settings.

4. Experiment 2

This experiment included two different snack types: baby carrots and ladyfinger cookies. The snacks varied in whether they are nutritious or less nutritious, but we also expected that children find the cookies more tasty than the carrots. The experiment was again conducted in a classroom setting, but no movie was shown. Compared to Experiment 1, this Experiment had even younger participants with an age between 3 and 6. Moreover, we used a repeated measures design to test the effect of portion size while controlling for individual differences in food liking, personal consumption habits or trait hunger. This indicates that children's state of liking and hunger was kept constant during all measurement moments. The participating children received large or regular portions during breaks at school.

4.1 Material and methods

4.1.1 Design

The second experiment had a 2 (package size: large vs. regular) × 2 (snack type: baby carrots vs. cookies) crossover design. The order of the experimental conditions across study weeks was randomly assigned across classrooms, to do this we used the alphabetical list of the classes. A crossover design, using repeated measures within subjects, was used to test the effect on food intake of varying the amount of baby carrots and ladyfinger cookies in boxes served to young children as a snack. We opted for this design because it levels out inter-individual differences that should otherwise be included as covariates. As a result, such a design typically has a higher power such that smaller sample sizes can be tolerated. On one day a week, for four weeks (sessions), children were provided with a snack in a box (snack

type: baby carrots vs. ladyfinger cookies; package size: large vs. regular) during the forenoon break in a school setting. The snack was consumed ad libitum out of the box.

4.1.2 Participants

For the second Experiment we selected even younger children, with an age between 3 and 6 years old. Earlier research already demonstrated that from the age of 3 on larger portion sizes lead to increased consumption (see Rolls et al., 2000). Recruitment began by distributing letters to parents whose children were enrolled in selected schools in Brussels (Belgium). Parents and/or legal guardians provided informed written consent for the participation of their child. The institutional review board of (anonymous for peer review) reviewed and approved all procedures. Children of 4 different classes in 2 different schools participated. In total, 97 children's parents were contacted, with a non-response of 35. This non-response is high and probably due to the urban character of the schools with less involvement of parents within the school's community (Groves & Couper 1998; van Goor, Jansma & Veenstra, 2005).

A total of 61 children from four different classrooms were thus recruited, but only data of 55 children could be used for further analyses. 2 of the parents indicated their child was allergic to an ingredient in the cookies and 2 of them indicated that their child didn't like carrots. 2 children were ill during one of the four different sessions, making the other collected data not usable. So, the final sample consisted of 55 children, of which 26 were girls (47.3%) and 29 were boys (52.7%). The majority of the children was 4 years old (47.3%) followed by the group of the 5 years old children (27.3%) and the 6 years old children (21.8%). Only 2 children were 3 years old (3.6%). The average age of the participants was 4.67 years (SD = 0.86).

4.1.3 Procedure

The same procedure was followed as in Experiment 1. Participants were again recruited by contacting different schools. Instead of participating in one session, participants took part in the four sessions, so their consumption was now measured for all sessions. The order in which the four conditions were presented was randomized and manipulated between-subjects to counterbalance spurious effects due to presentation order. Liking and feeling of hunger were both measured in the same manner as in Experiment 1 (Birch, 1979). Children were only questioned at the start of the first session about their liking of carrots and cookies, which was in contrast to the hunger of children, that was assessed at each session.

The snacks were served in individual boxes per child in the classrooms at the regularly scheduled time during the break before lunch. Contrary to Experiment 1, the participating children were not asked to watch a movie. The snack was eaten at tables where three to six children and their teacher sat down, which is the standard practice in these schools. Children at the table who were not participating in the study were provided with the same snack, but their intake was not recorded. Once children were seated at their tables, they were served one of the two snacks in one of the two package sizes. The children were told they had to test snacks that would soon appear on the market. They were asked to indicate how much they liked it and in return, they could eat as much as they wanted. The instructions for the children in this Experiment were more detailed than for the children in Experiment 1, to make sure these younger children with lower levels of cognitive development understood the procedure. For instance, in the Food Dudes project (i.e., a project to increase children's fruit and vegetable consumption) children between 5 and 7 years were approached different from children between 8 and 11 years (Horne, Tapper, Lowe, Hardman, Jackson, & Woolner, 2004). All participating children got 10 minutes to eat their snack, similar to the usually scheduled snack time before a break. To guarantee anonymity during the session, all children

received a specific sticker with serial number corresponding to the serial number on his or her pack of the snack. The measurement of pre- versus post-snack weight was used. The procedure was filmed to control for unexpected circumstances. The children were allowed to leave the table when they had eaten as much as they wanted. After the last session, participants were debriefed by means of a short text, and had the opportunity to give any comments they might have. Teachers were instructed to redirect conversations pertaining to food to other topics during the sessions to minimize the influence on lunch intake.

4.1.4 Materials

The foods served were baby carrots (35kcal/100g) and ladyfinger cookies (400kcal/100g) from the local hypermarket Makro. Baby carrots were chosen as a healthy snack. This vegetable was chosen from among those that had been previously served at earlier studies (Kral, Kabay, Roe, & Rolls, 2010; Spill, Birch, Roe, & Rolls, 2010). We chose ladyfinger cookies as the more preferable and sugared food type. To keep the differences between the two food types as small as possible, we chose to use ladyfinger cookies that have the same rectangular form as baby carrots.

Both food types were offered in plain packaging. The smaller food packages contained 80 grams of carrots or 30 grams of cookies. In the large pack condition we used 130 grams of carrots and 48 grams of cookies. We used a difference of grams because the carrots weighed far more than the cookies per volume. It is important that the portions of the carrots and cookies looked the same, because children rely on visual estimations on the package to infer the amount of product that it contains (Chandon, 2013). To solve this difference and to measure the impact of food type on consumption, we ensured that the proportions within the food categories corresponded to each other: regular package with carrots/ large package with carrots = 80/130 = 0.62, regular package with cookies/ large package with cookies = 30/48 = 0.62. The portion sizes of these foods were based on

consumption data from previous research with children in this age group (Leahy, Birch, & Rolls, 2008a; Leahy, Birch, & Rolls, 2008b; Leahy, Birch, Fisher, & Rolls, 2008). These two different transparent boxes only differing in size were ordered online at a local retailer (see Figure 3). The regular packages had a diameter of 95 mm and were 65 mm deep. The large ones had a diameter of 109 mm and were 80 mm deep.

[INSERT FIGURE 3 ABOUT HERE.]

Fig. 3 Snack packages (regular and large packages of carrots and cookies).

4.2 Results

Overall, the children indicated to be hungry. The average value for the four sessions was 2.63 (*SD* = .50; significantly exceeding the neutral 2 score; $t(54) = 9.49$, $p < .01$). In terms of likeability, the participating children found cookies ($M = 2.87$, $SD = .43$) better than carrots ($M = 2.67$, $SD = .70$), but the difference was not significant ($t(54) = -1.797$, $p = .078$).

To test the effects of the package size manipulation and the food type on the amount of intake in grams, we performed a repeated measures ANOVA (without covariates) with package size and food type as independent variables and intake as dependent variable. Of course, testing the consumption for the two different food types is not as relevant given the different weight of both snack's serving sizes. To test Hypothesis 1 we report the main effect of package size. The package size manipulation produced a significant main effect ($F(1,54) = 8.45$, $p < .01$, $\eta p2 = .14$), confirming H1: children consume more when the package size is large ($M = 40.78$, $SD = 23.55$) instead of regular ($M = 33.45$, $SD = 16.48$). The main effect of food type (carrots vs. cookies) was significant, $F(1,54) = 15.34$, $p < .01$, $\eta p2 = .22$). The mean consumption was lower when a pack with cookies was offered ($M = 29.07$, $SD = 10.91$) compared to when a pack with carrots was offered to the children ($M = 45.15$, $SD = 31.55$). However, the weight per volume ration differs between carrots and cookies. Therefore, we

also tested Hypothesis 2 by comparing the proportional consumption of carrots and cookies. This main effect was significant, $F(1,54) = 149.491$, $p < .01$, $\eta p2 = .48$). The mean proportional consumption was lower when a pack with carrots was offered ($M = .45$ $SD = .31$) compared to when a pack with ladyfinger cookies was offered to the children ($M = .79$, $SD = .28$). In sum, the findings disconfirm H2 when looking at absolute weight of snack eaten, but they confirm H2 in terms of the visual amount (i.e. proportion or volume) of snack eaten.

To explore possible interaction effects (H3) we did not use the repeated measures analysis. Instead, we looked at the effect size per food type, again to accommodate for the differences in absolute weight of both. Paired-samples t-tests indicated that when children were offered cookies, they ate significantly more from the large pack ($M = 32.69$; $SD = 15.78$) compared to the regular one ($M = 25.45$; $SD = 8.56$), $t(54) = 4.143$, $p < .01$, $r = .572$, $d = .52$. In contrast to the cookies, package size did not affect consumption when children were presented with carrots: they did not eat significantly more from the large portion ($M = 48.87$; $SD = 41.04$) compared to the regular portion ($M = 41.44$; $SD = 29.96$), $t(54) = 1.604$, $p = .11$, $d = .20$. Although this latter effect size is still within the range of a possibly real but small effect, the effect size is clearly smaller than that for the more sugared ladyfinger cookies. We thus confirmed our third hypothesis. Figure 4 illustrates the consumption across the different conditions.

[INSERT FIGURE 4 ABOUT HERE.]

Fig. 4 Amount of consumption (in grams) per package size and snack type condition.

Although the design of Experiment 2 levels out inter-individual differences because of the repeated measures design, we carried out a mixed ANCOVA analysis with age, gender,

feeling of hunger and overall liking of carrots and cookies as covariates. No main or interaction effects of these covariates were found ($F < 1$).

4.3 Discussion

As in Experiment 1, we again found a package size effect, such that the participating children consumed more from large packs than from regular packs. In Experiment 2 we wanted to extend snacks to healthy snacks, more in particular to baby carrots. The good news is that children ate more carrots compared to cookies in grams. However, the less good news is that we have to take the proportion into account. As in Experiment 1, we found that children ate proportionally more of the sugared snack type (cookies) than of the less sugared one (carrots). Also confirming Experiment 1 and earlier findings among adults (Wansink & Kim, 2005), the results revealed that the package size effect is stronger for sugary snacks. When offered cookies, the participating children consumed more in the large pack condition than in the regular pack condition.

5. General Discussion

Two experiments investigated whether the package size effect also occurs for young children while snacking. We argued that children would eat more from a larger pack than a regular one, eat more of a tastier variant and that the effect of the package size is stronger for foods high in sugar content. We conducted two experiments, in a natural context where children are used to snack and in which we assessed how much they consumed from a small versus a large pack of a snack. Both in Experiment 1 and 2 we found a robust package size effect such that participants consumed more from a large than from a regular pack. In Experiment 1 and 2, children ate more of the more sugared snack than of the less sugared one. This last finding also emphasizes an unfavorable effect with potentially important health implications that others have already demonstrated before (supra).

Importantly, we found an interaction effect of package size and snack type in both studies. The influence of package size as a subtle environmental cue on children's consumption clearly was stronger for sugared snacks. In Experiment 2 the package size effect was even small to non-existent for the healthy option, i.e. the baby carrots. This finding that pack sizes mostly affect unhealthy foods is important and relates to the broader literature on how marketing cues affect children's liking and consumption of food. It has been shown that food marketing directed to children mainly includes snacks and fast food (Botha et al., 2008; Lodolce et al., 2013). The promotion of healthy foods is not common which could be a reason why this marketing cue did not impact children's intake of baby carrots. Research on endorser effects also found that endorsers are more persuasive for unhealthy foods than for healthy foods (Smits et al., 2015). Based on Experiment 2 it seems as if a similar pattern is true for package size as an external consumption cue and the question now is whether healthy foods can benefit to some extent of the package size effect. For example, recent research found that children's vegetable snack intake can be improved by serving larger portions in smaller-sized pieces (van Kleef, Bruggers, & de Vet, 2015).

We did not find any effects of the covariates in both Experiments. The role of hunger as covariate, however, should be discussed more in depth. Hunger manipulations were the same in both Experiments. Based on the findings, we can assume that the perception of hunger does not play an important role when consuming. The results suggests that hunger does not impact self-control among children when eating. Children can self-select a balanced diet and know when and how much to eat (Davis, 1939). Moreover, a recent study found that when children's impulse control is low, they are more prone to overeating less healthier foods then low impulsive children, irrespective of their hunger level (Nederkoorn, Dassen, Franken, Resch, & Houben, 2015).

Portion and package sizes have increased in the past years (Young & Nestlé, 2002), making supersized less-nutritious portions and packs of food an important factor that contributes to the rise in overweight and obesity (Chandon, 2013; Hill & Peters, 1998; Young & Nestlé, 2012; Zlatevska, et al., 2014). As obesity brings along all kinds of negative consequences when children grow older, the reduction of the expanding number is on the priority list of many governments (EU Pledge, 2015; Jensen & Ronit, 2015). Health authorities team up with international food manufacturers in order to conform the promotion of often unhealthy food to the prescribed food norms. They also strive for food promotion targeted at children to be more transparent and the limitation of certain marketing techniques on media channels for unhealthy food.

Based on the above described findings, we suggest that children need to be aware of the package size effect. However, subtle marketing cues, such as a manipulation of the package size, are purposely designed to unconsciously affect young children (Livingstone & Helsper, 2006). In line with the 'Food Marketing Defense Model' (Harris et al., 2009), young children most likely cannot protect themselves against such marketing strategies. Effects were found for children during adiposity rebound (i.e. Experiment 1), but for even younger children with an age of 3 as well (i.e. Experiment 2). It has been demonstrated that younger children are less able to recognize advertising and are less aware of its impact (Rozendaal et al., 2010). However, we found an impact of these subtle cues for children in both Experiments, indicating that such cues unconsciously influence children's eating behavior irrespective their age.

Furthermore, the frequency of snacking has increased in recent years and snacking typically occurs in situations with less parental controlled compared to actual meals (Piernas & Popkin, 2010). Prior studies already provided some insight in the effects of meals' serving sizes on children's food intake (Small et al., 2013), but there still is a lack of research

regarding snacking behavior. Our study is probably the first to show that children's snacking volume is influenced by the serving size, and that this effect depends on the sugar content of the snack.

5.1 Limitations

First, in Experiment the majority of the children ate almost the whole cup of popcorn. This could be a possible limitation, although we triggered the participating children to refrain from eating because of the weighing before the Experiment.

Second, we did not control for the children's BMI in Experiment 2, but due to the within-subjects design this is unlikely to have a substantial effect on the reported findings. Such a design reduces error variance associated with individual differences.

Third, the movie distractor was not included in Experiment 2. In Experiment 1 we asked the children to watch an Easter movie during which they were allowed to snack. In this study we wanted to replicate the findings of Wansink and Kim (2005) among young children. However, in Experiment 2 we tried to conceptually extend to another common snack setting for children. Children indeed often snack during breaks at school. Thus, in Experiment 2 we tried to simulate the snack setting at school as good as possible, which was without displaying a movie. In sum, we demonstrated a package size effect for children while distracted (cf, 'mindless eating'; Wansink & Sobal, 2007) and a similar effect for younger children in a probably less distracting setting. Further research might focus on whether these young children also demonstrate a pack size effect when multi-tasking during food consumption.

One of the overall limitations was the setting in which the data were collected: the classes of the children's school. The absence of a parent is an issue and limits the validity of the findings. However, snacking typically occurs in situations with less parental control. And although the setting approaches a more naturalistic context, children might react differently

when being home or in a store. In this setting the children ate together in one room, which could lead to possible peer effects.

5.2 Future research

We demonstrated that one package design aspect, the package size itself, has a clear effect. Future studies should examine the implicit effects of these environmental cues on children, in order to develop a better policy. Future research should therefore compare these effects between younger and older children. Prospective research should assess from which age children become aware of the aim of portion and package sizes. The exact underlying mechanism by which the package size effect occurs, warrants further research. Future experiments could also investigate how much attention children need to give to the package size to perceive the persuasive pack cue.

Next to possible variations of food intake between age groups, food type preferences can vary between countries but also between regions within the same country. Askegaard and Madsen (1998) argued that important differences in consumption patterns, behavior and attitudes exist. Therefore, this study should also be carried out in different countries, regions and with other snack types.

In line with previous research (Small et al., 2013), we found the effects of altering portion sizes of different kinds of food (e.g., changes in daily intake) with children older than 4 years of age. However, investigating for which snack type children are more susceptible to the package size effect is an interesting topic for further research. Specifically with regard to healthy snack options it should be investigated whether the package size effect can contribute.

6. Conclusions

Our research complements the prior found effects of package size on adult's consumption by finding evidence for the fact that package shapes can affect children' s consumption of tasty foods, as well as ones that are not as tasty. This finding had direct consequences for age-appropriate portion education and training interventions on dietary intake (Small et al., 2013; Wansink, 2006). First, this is needed because a portion that is deemed the appropriate size for a 3 year old would probably be smaller than a portion deemed appropriate for a 6 year old. Second, this is needed because children have different stages of cognitive development, awareness, and self-control. Our findings suggest that policy makers could reduce unhealthy consumption by regulating package design aspects, but they also highlight the need for further research on this topic.

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